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Automated Floor Cleaner Robot

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Abstract - The automated floor cleaner robot is a compact and intelligent device designed to perform cleaning tasks autonomously. Equipped with sensors, a microcontroller, and efficient cleaning mechanisms, it offers a practical solution for maintaining cleanliness in residential and commercial spaces. The robot integrates advanced technologies such as ultrasonic or infrared sensors for obstacle detection, motorized brushes or vacuum systems for cleaning, and rechargeable batteries for extended operation.Using path-planning algorithms, it navigates efficiently while avoiding obstacles and covering the entire floor area. Some models incorporate Wi-Fi connectivity, enabling remote control and real- time monitoring via mobile applications. The addition of machine learning or AI capabilities can allow the robot to The development of the project though it was an arduous task, it has been made by the help of many people.

1. INTRODUCTION

Automated floor cleaner robots represent a significant innovation in the field of robotics and smart home technology, providing an efficient and hands-free solution to maintaining clean and hygienic floors. These robots are designed to perform floor cleaning tasks autonomously, reducing the time and effort required for manual cleaning. Equipped with advanced technologies such as sensors, navigation systems, and intelligent algorithms, they can navigate through various environments, avoiding obstacles and adapting to different floor types like tiles, hardwood, and carpets.The core functionality of these robots includes sweeping, vacuuming, and sometimes mopping, ensuring a comprehensive cleaning experience. Many modern models incorporate features such as scheduling, smartphone app control, and even voice assistant integration, making them highly user-friendly and customizable.

Literature Review

Zarinabegam Mundargi, Deepak jadhavar, Vishal Bolke, Anandita Singh, explores existing studies and technologies in the field of robotic cleaning systems. It focuses on the integration of essential components such as DC motors, ultrasonic sensors, and cleaning mechanisms, emphasizing modular designs that allow for customization and future enhancements. Key insights underline the importance of accurate obstacle detection and efficient navigation algorithms, which are critical for achieving thorough cleaning coverage and collision avoidance. Ultrasonic sensors and intelligent path-planning strategies are commonly employed to address these challenges.Performance evaluations from previous works highlight factors such as cleaning efficiency, navigation accuracy, and userfriendliness, with many studies comparing different approaches to identify best practices. The costeffectiveness of using Arduino Uno as the primary microcontroller platform is frequently noted, owing to its affordability and ease of use. Advanced studies delve into the integration of additional technologies such as Raspberry Pi, machine learning

algorithms, and remote control features, which enhance functionality and adaptability[1].

Akash Rathee, Ishant Jalan, Lakshita Nandwani presented The Smart Floor Cleaning Robot is an efficient and cost-effective device designed to automate floor cleaning tasks in domestic and industrial

environments. Controlled wirelessly through an Android smartphone via a Bluetooth module (HC-05), the robot simplifies cleaning by performing movements and mopping actions based on user commands. Key hardware components include an Arduino Uno microcontroller, L293D motor driver for mobility, a submersible water pump for wet cleaning, and a rechargeable 12V battery. Upgrading to the HC-12 Bluetooth module could further enhance wireless communication range and reliability.It demonstrates the potential of embedded systems to provide practical and innovative cleaning solutions. By combining simplicity, affordability, and user-friendliness, it offers a significant improvement over traditional cleaning methods[2].

Suyog Pati developed a smart and autonomous floor-cleaning robot designed to simplify household cleaning tasks, emphasizing efficiency, cost-effectiveness, and user convenience. The robot combines dry cleaning functionality with a vacuum pump for effective dust removal. It is equipped with an Arduino Mega 2560 microcontroller, ultrasonic sensors for obstacle detection, and a motorized chassis for movement. The robot follows a zigzag cleaning path, autonomously navigating rooms to maximize coverage. Users can switch between manual and autonomous modes via a mobile application, enabling flexible operation. previous robotic floor cleaners that faced challenges like limited obstacle avoidance and inefficiency in reaching small spaces. This design addresses those issues by integrating advanced obstacle detection, a systematic cleaning algorithm, and wireless control for enhanced usability[3].

Shyam Kondeti presented innovative automated floor-cleaning systems, each with unique approaches.
The first paper details a "Smart Floor Cleaning Robot" using an Arduino Mega 2560 microcontroller and ultrasonic sensors for obstacle detection, emphasizing autonomous cleaning with a zigzag path algorithm and a vacuum pump for effective cleaning. Its future scope includes features like disinfectant integration, 2D mapping, and cost optimization. The second paper, "Auto Clean: Android-Powered Floor Cleaner," employs an 8051 microcontroller with Bluetooth connectivity for Android-based manual control. It uses ultrasonic sensors for obstacle avoidance and incorporates a mop and broom for dry cleaning. Future enhancements include image-based navigation, voice control, and automatic charging. While the first paper focuses on advanced autonomous cleaning for larger spaces, the second offers a cost-effective, manually controlled solution for simpler tasks. Both approaches highlight promising advancements in the automation of cleaning systems, with potential for combining their strengths in future designs[4].

2. PROPOSED METHOD:

The proposed concept for an automated floor cleaner robot envisions a compact, autonomous device designed to perform efficient and reliable cleaning tasks with minimal human intervention. Equipped with advanced sensors, a microcontroller, and a motorized cleaning system, the robot will feature a navigation system utilizing ultrasonic, infrared, or LiDAR sensors to map its environment, detect obstacles, and navigate seamlessly across

various flooring types, including tiles, wood, and carpets. The cleaning mechanism will combine rotating brushes and a vacuum system to collect dust and debris, complemented by a mopping attachment for wet cleaning using water or a cleaning solution. Power management will be optimized with a rechargeable battery capable of extended cleaning sessions, along with automatic docking and charging capabilities to ensure uninterrupted operation. Smart features such as programmable cleaning schedules, integration with mobile apps or smart home systems for remote control, and AI-powered dirt detection will enhance user convenience and cleaning efficiency by focusing on heavily soiled areas. Its compact design will allow the robot to clean hard-to-reach spaces, such as under furniture and in tight corners. Safety and user- friendliness will be prioritized through anti-collision and anti-fall sensors, easy maintenance with replaceable cleaning parts and washable filters, and a usercentric approach. This innovative robotic cleaner aims to deliver a cost-effective, eco-friendly solution that upholds high standards of cleanliness, catering to the growing demand for automated cleaning technologies in modern households and commercial spaces.

Fig 3.1:Circuit Diagram of the project

3. RESULTS:

The performance and effectiveness of an automated floor cleaner robot depend on various factors.

Dirt and Dust Removal High-quality robots effectively clean hard floors, carpets, and rugs by sweeping, vacuuming, and mopping.Spot Cleaning They perform well in targeted areas with specific messes.Edge Cleaning Modern robots are designed to clean corners and edges with side brushes. Advanced models avoid furniture, walls, and obstacles using sensors or cameras.Smart Mapping Many robots create a map of your home for efficient navigation, ensuring no area is missed.Multi-Floor Support Some robots can save maps for multiple floors.Automation Robots clean without manual intervention, freeing up time for other tasks.Deep Cleaning Automated robots may not be as thorough as manual cleaning for deep stains or heavy messes.Battery Life Depending on the model, battery life may limit the cleaning session's duration.Ease of Use Dustbins, filters, and brushes are easy to clean and replace. Sensors and parts may require occasional maintenance or replacements.Initial Highquality robots can be expensive but save time and effort in the long run.Energy Efficient Generally consume less energy compared to manual vacuums.

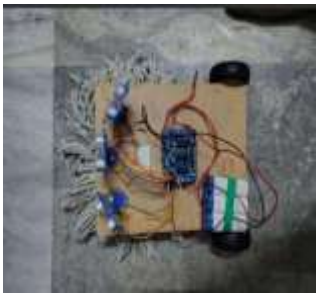

Fig 4.1 Fig 4.2

Fig 4.1 & 4.2: This shows the model of the project

v. CONCLUSION:

The existing systems in automated floor cleaner robots typically include advanced technologies such as sensors, cameras, and mapping algorithms to enhance cleaning efficiency and navigation. These robots are equipped with lidar or infrared sensors for obstacle detection, ensuring they avoid collisions and drop-offs like stairs. Many incorporate gyroscopic or visual SLAM (Simultaneous Localization and Mapping) systems to create accurate maps of the environment, enabling systematic cleaning paths rather than random movements. Suction and brushing mechanisms, combined with features like wet mopping, cater to various floor types. The automated floor cleaner robot represents a transformative step in leveraging robotics tosimplify everyday tasks. By combining advanced sensors, intelligent navigation, and efficient cleaning mechanisms, it offers a practical solution for maintaining cleanliness in residential, commercial, and industrial environments.This innovation not only reduces human effort and saves time but also ensures consistent and thorough cleaning, contributing to healthier living and working spaces. Its ability to integrate with smart home systems, adapt to various surfaces, and operate autonomously highlights its potential as an indispensable tool for modern lifestyles.

VI. FUTURE WORK:

Further advancements and improvements in automated floor cleaner robots could focus on enhancing their functionality, efficiency, and user experience.

Here's an outline of potential development. Enhanced sensors for better differentiation between floor types (e.g., tiles, hardwood, carpets) to optimize cleaning modes.Incorporating cameras and AI to identify tough stains and focus cleaning on those areas.Automatic cleaning of brushes and filters to reduce maintenance requirements. Integration of sustainable cleaning solutions and water-saving mechanisms.Robots learning room layouts and user preferences over time for improved cleaning efficiency.Real-time recognition and adaptation to new obstacles (e.g., toys, cables).Enhanced Edge and Corner Cleaning Improved designs for better access to hardtoreach areas.Seamless navigation across multiple levels of a home, including the ability to climb small stairs or transitions.Compatibility with smart home systems (e.g., Alexa, Google Home) for voice commands and remote control.Notifications for completed tasks, maintenance needs, or detected issues via a smartphone app.Advanced battery technologies (e.g., solid-state batteries) for extended

runtime.Faster charging and wireless charging docks. Robots that can vacuum and mop simultaneously with separate reservoirs for dry and wet cleaning.Incorporation of UV light to sanitize floors while cleaning.HEPA filters and advanced filtration systems for cleaner air.Development of cost-effective models with essential features for broader market accessibility.Use of eco-friendly and recyclable components.Quieter operation for minimal disruption in households.

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